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POWER COST STUDY:

VIRGINIA 41 PRINCE WILLIAM

UNITED STATES DEPARTMENT OF AGRICULTURE  
U.S. RURAL ELECTRIFICATION ADMINISTRATION  
WASHINGTON 25, D. C.

JUNE 13, 1951

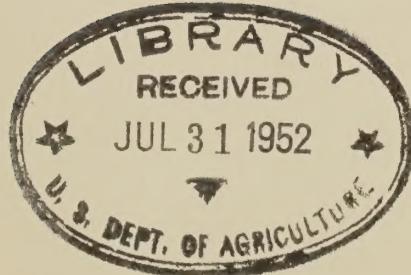
Power Division //

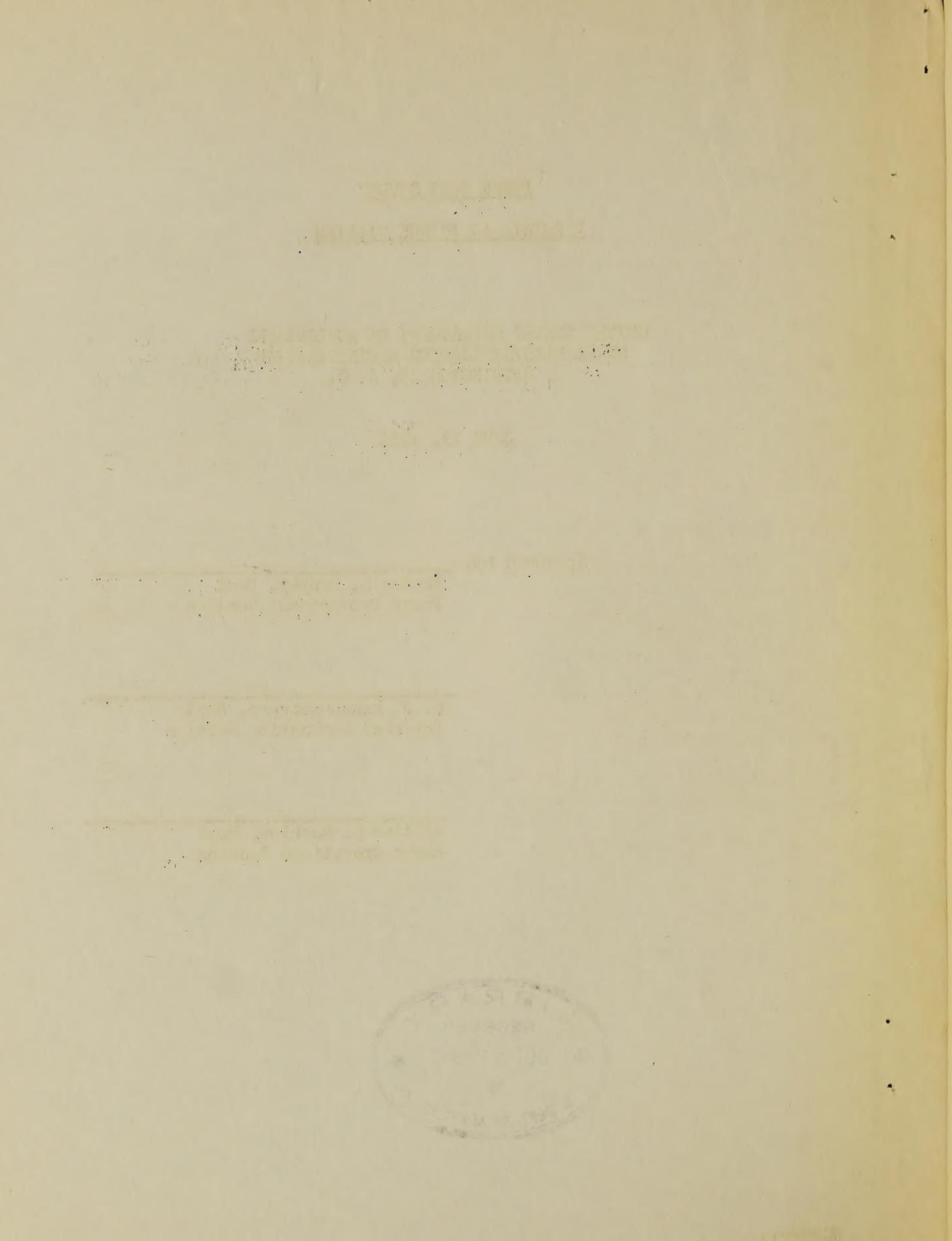
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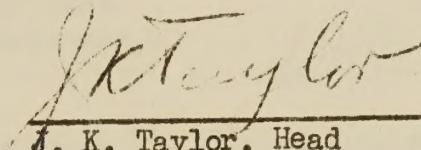
SYSTEM POWER ANALYSISVIRGINIA 41 PRINCE WILLIAM

The Prince William Electric Cooperative of Manassas, Virginia (Virginia 41 Prince William), currently generates all of its power requirements with its diesel generating plant at Manassas. The cooperative's generating facilities have a total firm capacity of 3,390 kw. Current load estimates indicate that the cooperative's demand will soon exceed this firm capacity. In order to serve adequately the future loads and to assist in correcting system voltage regulation difficulties, the cooperative should establish two purchase power substations. A loan to the cooperative of \$180,000 should be made for improvements to the generating plant, for conversion of the three 1000 kw units to dual-fuel operation, and for funds to reimburse the cooperative's general funds for past expenses in connection with the construction of the generating plant.

A stop order on the \$180,000 covered herein should be established pending justification by the cooperative of the generating plant construction expenditures from general funds to the satisfaction of the Accounting and Auditing and Power Divisions. The stop order should also require submission by the cooperative of a contract for the gas supply or other evidence satisfactory to the Power Division of availability and cost.

Under the plan proposed in this study, it is estimated that power will cost 1.15 cents per kwh when the allocated load of 19,300,000 kwh per year has been achieved.

The Prince William Electric Cooperative is not a member of the Old Dominion Power Cooperative.

  
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J. K. Taylor, Head  
Power Planning Staff  
Power Division

10. *Leucosia* (Leucosia) *leucostoma* (Fabricius) (Fig. 10)

1940-1941

POWER COST STUDY  
VIRGINIA 41 PRINCE WILLIAM

INTRODUCTION

The Prince William Electric Cooperative is in need of additional funds to correct mechanical deficiencies in its diesel generating plant, to convert the three 1000 kw Superior units in the plant to dual-fuel operation, and to reimburse general funds for past expenses in connection with the construction of the generating plant. It is also necessary for the cooperative to establish two substations to obtain power from the VEPCo. This study analyzes the cost of power resulting from the changes outlined above and for comparison analyzes the costs if all power requirements are met by additions to the generating plant and transmission construction. The additional substations recommended will assist in correcting some of the voltage regulation difficulties the cooperative has been experiencing.

CONCLUSIONS

A loan of \$180,000 will be required by the Prince William Electric Cooperative to permit correction of mechanical difficulties at the plant, to provide the most economical operation of the plant, and to reimburse the cooperative's general funds for past generating plant construction expenses.

The \$180,000 will be used essentially as follows:

Conversion of 3-1000 kw Superior Unit to Dual-Fuel Operation \$ 40,000

Correction of Mechanical Difficulties 40,000

Reimbursement of General Funds for Past Generating Plant Construction Expenses 100,000  
\$180,000

When the conversions and changes recommended in this study are completed and the system is operating at its allocated condition of 19,300,000 kwh per year, it is estimated that the cost of power will average 1.15 cents per kwh.

The following table shows the estimated costs of power for the various periods considered in this study.

	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
KWH @ SS	17,700,000	24,000,000	29,100,000	19,300,000
Cost ( $\text{¢}/\text{kwh}$ )	1.17	1.02	.94	1.15

## PRESENT SYSTEM

This cooperative presently generates all of its power requirements at its Manassas diesel generating plant. The project load has already reached a demand of 2560 kw and it is expected to exceed the firm capacity (3390 kw) of the plant within a short time.

The present plant consists of the following generating units:

2 - 240 kw 480

2 - 375 kw 750

3 - 1000 kw 3,000

1 - 60 kw (skid) 60

2 - 50 kw (Mobile #22) 100

4,390 kw

Less largest unit 1,000 kw

Firm 3,390 kw

The plant is presently operating on diesel fuel oil. Gas is available in the area and to lower generation costs provisions are being made in this loan to convert the three 1000 kw units to dual-fuel operation. Conversion of the other older units is not recommended as it would be quite expensive to convert them and they are and will be used only for stand-by and firming up of the larger units. The distribution system of the cooperative has had voltage regulation difficulties and it is, therefore, necessary to establish new feeder points through purchased power or by transmission from the plant.

## WHOLESALE POWER

The wholesale power situation in Virginia has been clouded by the action of the State Corporation Commission in connection with the Old Dominion Power Cooperative. The Virginia Electric and Power Company has offered the cooperatives a 7.5 mill rate which has not as yet been approved because of certain objectionable contract features. The effect of SEPA and Buggs Island power is also uncertain at this time. This cooperative is not a member of the Old Dominion Power Cooperative. It is located at a considerable distance from the Buggs Island hydro development. The last quoted rate from SEPA averages 7.5 mills at a 40 percent load factor, 6.97 mills at a 50 percent load factor, and 6.75 mills at a 55 percent load factor. VEPCo's current wheeling charges, including one mill payable by SEPA, would add 1.5 mills to these costs. In view of the foregoing, we have used 7.5 mills per kwh at the high side of the substation as the cost of purchased power.

## GAS AVAILABILITY

Natural gas pipe lines are already operating through the area of this cooperative to serve Washington and vicinity. The Virginia Gas Distribution Corporation, which operates these lines, is expanding its facilities to serve the Manassas area and the cooperative's generating plant. The company apparently is currently involved in rate hearings and negotiations. It apparently has been willing to quote the cooperative rates and service on a verbal basis but has not been willing to make formal written proposals pending final adjudication of the rate problem with its other customers. The company apparently has given every verbal assurance to the cooperative concerning the rate and availability of service.

The rate which the company has offered is as follows:

Service Charge \$75 per month

First 50 MCF @ 60¢

Next 100 MCF @ 50¢

Next 350 MCF @ 40¢

Over 500 MCF @ 36¢

It is expected that gas will be available at least eight months every year and with small amounts possibly available during the other months. In this study we have assumed that gas will be available only during the eight months to assure conservative estimates.

## ALTERNATIVE PLANS

Two methods of supplying the future power requirements of this cooperative have been considered in this study.

Plan A provides for the conversion of the three 1000 kw Superior units in the plant to dual-fuel operation, correction of mechanical difficulties in the present plant, and use of the plant to serve that portion of the cooperative's system closest to the plant. The balance of the system is to be served by two substations served by the Virginia Electric and Power Company -- one of the substations to be located in the vicinity of Independence Hill and the other in the vicinity of Warrenton. This plan does not require installation of additional generating capacity at this time.

Plan B provides for the expansion of the plant with three approximately 1000 kw units to serve the entire cooperative load in conjunction with transmission to serve new substations at Independence Hill and Warrenton. The plan will require the construction of approximately 30 miles of 33 kv transmission and

two step down substations. It also provides for the conversion of the existing three 1000 kw units to dual-fuel operation and correction of the mechanical differences. The additional units would be dual-fuel.

This study does not cover the funds required to construct the outlying substations in either plant and the annual costs do not include their costs of operation and maintenance, as they would be a part of the distribution system under the purchased power plan (Plan A).

The costs of power under the plans outlined are estimated as follows:

<u>Year</u>	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
Plan A (Gen.&Pur.) (¢/kwh)	1.17	1.02	.94	1.15
Plan B (All Gen.)	1.41	1.17	1.05	1.28

#### COST OF POWER

The table below shows the cost of power for the recommended plan (Plan A), generation and purchased, for the various years considered in this study.

#### POWER COSTS

<u>Year</u>	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
Generated Power	\$142,396	\$161,097	\$174,353	\$142,340
Purchased Power	64,700	84,100	99,000	70,000
Total	\$207,096	\$245,197	\$273,353	\$212,340
KWH @ SS	17,700,000	24,000,000	29,100,000	19,300,000
¢/kwh	1.17	1.02	.94	1.15

The above costs include all costs in connection with the generating plant and purchased power. It does not include any investment or operating costs in connection with the two outlying substations.

#### LOAD DATA

The load data used in this study were received from K. N. Hardy on May 17, 1951. Load distribution among the plant and the outlying substations whether served from the plant or with purchased power has been determined on the basis set up in Mr. Hardy's memorandum of May 22, 1951. These load data are summarized in Appendix I.

APPENDIX I

LOAD DATA

VIRGINIA 41 PRINCE WILLIAM

	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
<u>Farm</u>				
No. of Members	2,893	3,562	4,037	3,489
Avg. KWH/Member/Yr.	2,280	2,880	3,300	2,400
Total Yearly KWH	6,600,000	10,270,000	13,300,000	8,370,000
<u>Non-Farm</u>				
New Members	641	792	900	474
Avg. KWH/Member/Yr.	2,280	2,880	3,300	1,500
Total Yearly KWH	1,460,000	2,280,000	2,970,000	711,000
<u>Small Commercial</u>				
No. of Members	62	77	100	112
Avg. KWH/Member/Yr.	6,240	6,480	6,600	6,000
Total Yearly KWH	387,000	500,000	660,000	672,000
<u>Large Commercial</u>				
No. of Members	8	9	9	10
Avg. KWH/Member/Yr.	178,500	187,000	195,500	159,600
Total Yearly KWH	1,428,000	1,680,000	1,755,000	1,596,000
<u>Seasonal</u>				
No. of Members	290	354	448	290
Avg. KWH/Member/Yr.	300	360	420	300
Total Yearly KWH	87,000	128,000	188,000	87,000
<u>Utility</u>				
No. of Members	1	1	1	1
Avg. KWH/Member/Yr.	2,302,000	2,412,000	2,520,000	2,133,999
Total Yearly KWH	2,302,000	2,412,000	2,520,000	2,133,999
<u>Street Lighting</u>				
No. of Members	5	5	5	5
Avg. KWH/Member/Yr.	17,479	17,479	17,479	17,479
Total Yearly KWH	87,500	87,500	87,500	87,500
<u>Military</u>				
No. of Members	1	1	1	1
Usage	700 KW	700 KW	700 KW	700 KW
Annual KWH @30% L.F.	1,840,000	1,840,000	1,840,000	1,840,000
With Line Loss 20%	2,300,000	2,300,000	2,300,000	2,300,000

APPENDIX I (Cont'd)

Virginia 41 Prince William

	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
No. of Members	3,901	4,801	5,501	4,382
*KWH Consumption	14,191,500	19,197,500	23,320,500	15,497,499
% Distribution Losses	20	20	20	20
KWH net@ SS	17,700,000	24,000,000	29,100,000	19,300,000
**Load Factor %	50	55	55	53
***Peak KW	4,230	5,200	6,250	4,380

\*Includes KWH for Military Consumer

\*\*For all except Military Consumer

\*\*\*Military Consumer demand added in separately

Load Distribution

Warrenton SS KWH	3,520,000	4,950,000	6,100,000	3,900,000
Warrenton SS KW	875	1,030	1,265	840
Independence Hill				
SS KWH	5,120,000	6,270,000	7,100,000	5,430,000
Independence Hill				
SS KW	1,345	1,523	1,715	1,374
Plant KWH Net	9,060,000	12,780,000	15,900,000	9,970,000
Plant KW	2,080	2,647	3,006	2,166
Total KW	4,230	5,200	6,250	4,380
Total KWH	17,700,000	24,000,000	29,100,000	19,300,000

APPENDIX II  
INVESTMENTS

PLAN A (Generated & Purchased Power) (Recommended Plan)  
Does not provide for additional plant capacity at this time

Convert existing 1000 kw National Supply units from straight oil to dual-fuel operation -

Parts	\$ 27,000
Manufacturer's Supervision	2,500
Labor	4,500
Contingency	<u>6,000</u>
Total	\$ 40,000

Correct design and rehabilitate existing radiator cooling system, etc. -

Labor and Material	\$ 35,000
Engineering	3,500
Contingency	<u>1,500</u>
Total	\$ 40,000

Reimbursement of cooperative's general funds for previous generating plant - Construction Expenses

Construction Expenses	\$100,000	<u>\$100,000</u>
Total		\$180,000
This Request		\$180,000

APPENDIX IIINVESTMENTSPLAN B (All Generation) All years through 1960I Generation (Add 3 - approx. 1000 kw dual-fuel generating units)

1. Remove units 4, 5, and 6 including foundation	\$ 5,000
2. 3-1000 kw dual-fuel generating units complete including auxiliaries & mechanical work	500,000
3. Foundation and Structural Work	40,000
4. Electrical Work	45,000
5. Engineering and Legal	35,000
6. Overhead & Contingency	<u>25,000</u> \$ 650,000

II Substation

1. Material & Labor	\$ 90,000
2. Contingency & Overhead	6,000
3. Engineering & Legal	<u>4,000</u> \$ 100,000

III Plant Improvements & Changes (See details under Plan A)IV Reimbursement of Cooperative's General Funds for Previous Power Plant Construction (See details under Plan A) \$ 100,000V Transmission Investment 30 miles 33 kv @ \$4400/mile \$ 132,000

Total \$1,062,000

INVESTMENT RECAPITULATION

<u>Year</u>	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
Plan A (Generation & Purchase)	\$ 180,000	\$ 180,000	\$ 180,000	\$ 180,000
Plan B (All Generation)	\$1,062,000	\$1,062,000	\$1,062,000	\$1,062,000

INVESTMENT THIS REQUEST

Recommended Plan (Plan A) \$ 180,000

(See discussion of stop order on this amount (\$180,000) included in System Power Analysis.)

APPENDIX II (CONT'D)

PREVIOUS GENERATING PLANT INVESTMENTS

<u>Amount</u>	<u>Approximate Date of Loans</u>
\$150,000	1940 and Previous
75,650	April 1941
76,350	February 1943
20,166	February 1943 (Adjustment of '41 & '43)
240,000	June 1946
240,000	April 1947
<u>11,315</u>	<u>September 1947</u>
 <u>\$813,481</u>	 Total



APPENDIX III  
YEARLY EXPENSES

PLAN A (Generation & Purchase)

	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
I Generation				
KWH Net	9,060,000	12,780,000	15,900,000	9,970,000
KWH Gross @ 5% SS	9,550,000	13,450,000	16,600,000	10,500,000
KWH Dual-fuel	6,370,000	8,960,000	11,050,000	7,000,000
Gross KWH Oil	3,180,000	4,490,000	5,550,000	3,500,000
Peak KW	2,080	2,647	3,270	2,166
Fuel (DF) (1)	\$ 25,360	\$ 35,090	\$ 42,410	\$ 27,930
Fuel Oil (1)	23,250	32,480	40,400	25,300
Lube	2,110	2,990	3,690	2,330
Payroll	23,500	23,500	23,500	23,500
Maintenance Materials	6,700	6,700	6,700	6,700
Other Opt. Supplies & Expenses	2,000	2,000	2,000	2,000
Taxes & Insurance	9,000	9,000	9,000	9,000
Replacement	-	-	-	2,500
Interest (Old)	15,244	14,105	11,811	
Interest (New)	3,600	3,600	3,210	
Depreciation (Old)	25,232	25,232	25,232	
Depreciation (New)	5,400	5,400	5,400	
Interest & Amortization (Old)	-	-	-	34,700
Interest & Amortization (New)	-	-	-	7,380
Miscellaneous	1,000	1,000	1,000	1,000
Totals	\$142,396	\$161,097	\$174,353	\$142,340
II Purchased Power				
KWH	8,640,000	11,220,000	13,200,000	9,330,000
Rate (¢)	.75	.75	.75	.75
Dollars	\$ 64,700	\$ 84,100	\$ 99,000	\$ 70,000
III Summary - Plan A				
Purchased Power	\$ 64,700	\$ 84,100	\$ 99,000	\$ 70,000
Generated Power	142,396	161,097	174,353	142,340
Total	\$207,096	\$245,197	\$273,353	\$212,340
KWH @ SS	17,700,000	24,000,000	29,100,000	19,300,000
¢/kwh	1.17	1.02	.94	1.15

APPENDIX III  
YEARLY EXPENSES

PLAN B (All Generation)

	<u>1952</u>	<u>1955</u>	<u>1960</u>	<u>Allocated</u>
I Generation				
KWH Net	17,700,000	24,000,000	29,100,000	19,300,000
KWH Gross 5% SS	18,600,000	25,300,000	30,700,000	20,300,000
Peak KW	4,230	5,200	6,250	4,380
Installed KW	6,535	6,535	6,535	6,535
Firm KW	5,535	5,535	5,535	5,535
Fuel (DF) (1)	\$ 48,210	\$ 64,300	\$ 78,490	\$ 52,160
Fuel Oil (1)	45,600	60,800	73,900	48,500
Lube	4,140	5,620	6,820	4,520
Payroll	29,000	29,000	29,000	29,000
Maintenance Materials	10,000	10,000	10,000	10,000
Other OS&E	3,000	3,000	3,000	3,000
Taxes & Insurance	13,500	13,500	13,500	13,500
Replacements	-	-	-	3,700
Interest (Old)	15,244	14,105	11,811	-
Interest (New Rehab.)	3,600	3,600	3,210	
Interest (New Install.)	15,000	15,000	13,300	
Interest & Amortization (Old)	-	-	-	34,700
Interest & Amortization (Rehabilitation)	-	-	-	7,380
Interest & Rehabilitation (New Installation)	-	-	-	30,800
Depreciation (Old)	25,232	25,232	25,232	-
Depreciation (Rehab.)	5,400	5,400	5,400	
Depreciation (New Install.)	22,500	22,500	22,500	
Miscellaneous	1,500	1,500	1,500	1,500
Totals	\$241,926	\$273,557	\$297,663	\$238,760
Net KWH	17,700,000	24,000,000	29,100,000	19,300,000
¢/kwh	1.36	1.14	1.02	1.24
II Transmission				
Operation	1,800	1,800	1,800	1,800
Maintenace				
Depreciation (2.75%)	3,630	3,630	3,630	-
Interest & Amortization	-	-	-	5,410
Interest	2,640	2,640	2,420	-
Miscellaneous	100	100	100	100
Totals	\$ 8,170	\$ 8,170	\$ 7,950	\$ 7,310
III Summary - Plan B				
Generation	\$241,926	\$273,557	\$297,663	\$238,760
Transmission	8,170	8,170	7,950	7,310
Total	\$250,096	\$281,727	\$305,613	\$246,070
Net KWH	17,700,000	24,000,000	29,100,000	19,300,000
¢/kwh	1.41	1.17	1.05	1.28

APPENDIX III (Cont'd)

(1) Fuel - Dual-fuel Operation

Gas expected to be available during eight months of the year. Since cooperative loads are highest in months gas is available, we have assumed dual-fuel operation for 66.6 percent of the kwh.

Fuel performance      Gas 9,500 BTU/KWH gross  
                            Oil 950 BTU/KWH gross  
                            Gas 1,100 BTU/cuft  
                            Oil 140,000 BTU/gal    \$.10/gal

Gas Cost - See rate under availability of gas  
Fuel Oil Performance 13.8 KWH/gal.

1920-1921 - 1922-1923

1920-1921 - 1922-1923

1920-1921 - 1922-1923